most of the work is often done by ordinary untrained coolies, who will use nothing but the tools they are accustomed to handle. And very often it will be found that these tools are more suitable for the work to be done by the class of men available than English implements.

2. Of Indian tools which are admirably adapted to the purposes for which they are used may be mentioned, besides the usual and well-known agricultural instruments, the "'vahaula" or "hoe axe", used for stubbling out roots, etc.; the "kurpa", or "ramba" of universal use by coolies in nearly all gardening operations; and the grass-cutters "daranti".

3. Hedge-pruning instruments of English make are, however, necessary. These are a hedger's bill or bill-hook, shears, and pruning knives.

4. In pruning and thinning the following instruments are required:—

Sharp knives

Indian saws (thick for greenwood), with long and short handles.

Pruning chisels, with long and short handles.

Wooden mallets.

Pruning knives are made with or without a hinge.

5. Pruning saws ought to have very fine teeth, and some ought to be provided with handles of various lengths, to reach branches at different heights. The Indian saw differs from the common saw in having the teeth pointed inwards, and is thus used by being drawn towards the operator. This saw is well fitted for removing branches at a distance from the pruner. For large branches saws about 18 inches long are well adapted.

6. The long-handled pruning chisels are used when the pruner cannot otherwise reach the branches, or finds it difficult to remove them with the saw. Some implements are shown in plate No. I.

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## CHAPTER V

### Collection and Preparation of Seed

1. Trees for planting avenues may be obtained from seed, cuttings, or root suckers. Other forms of propagation, such as

layering, grafting, budding and inarching belong to gardening and would rarely be employed and then only in the vicinity of large towns where skilled advice can be obtained.

*Collecting seeds*

2. It is generally preferable to select for avenues trees which grow naturally in the locality or have become already acclimatised in it, if suitable for the purpose, as it is easy to judge of their adaptability to the soil and climate; and in such case it is better to collect the seed locally as it can then be had fresh and good. But if it is desired to try trees, the seed of which cannot be collected in or near the district, good seed can be obtained at small cost from any of the public gardens, such as the Department of Parks and Gardens, Fort Bombay, the Empress Gardens, Poona, the Victoria Gardens, Bombay, etc.

3. Seeds should not be collected until they are ripe. There are generally signs, characteristic for each kind of tree, by which the ripeness of the seed may be recognised; as a rule sound seeds are moist, of full weight, and of a healthy colour and appearance when fit to gather. The seasons in which the seeds of each kind of tree recommended for cultivation ripen are given as far as possible in the list of trees suitable for road-side planting; but this should be taken only as a general guide as the time of ripening varies in different localities. Many trees shed their seed as soon as it is ripe and, as it is often easier to gather the seed while still on the tree, the progress of the ripening of such trees should be carefully watched so that the seed may be gathered before it is shed. In other cases, such as sissu, babul, etc., the seed remains on the trees for a long time and keeps well, and the same care is not required. The best seed is furnished by healthy mature trees alone and care should be taken that the seed is collected from full grown, well formed and sound trees. The seed should be collected on dry days and, when gathered, should be spread out to dry in the shade.

*Clearing seed and preparing it for sowing*

4. In many cases it is necessary to remove the fruit or other covering of seeds by artificial means before sowing them or preserving them for sowing at a later date. Where the seeds are contained in pods the pods open naturally when dry and either shed their seed or at most a little threshing or other

manipulation will be required. Where the seeds are enclosed in a fleshy covering as in the case of the ber and edible stone-fruits, this covering can be rotted off by burying the fruits in layers in moist earth or sand. Some seeds such as those of the teak have hard coverings, which can only be removed by prolonged treatment in this manner. If the quantity to be dealt with is not large and the saving of time an object, seed of the above description may be prepared for sowing by being soaked in water and frequently stirred for a considerable time, or by being buried in moist manure, where they will get both warmth and moisture, and kept there until they are about to germinate. Seeds of the Ficus species germinate best if sown on the top of a layer of half decomposed cowdung in a shady place.

5. Some seeds germinate better after keeping or after passing through the bodies of birds or fruit eating animals. Babul seed, for instance, gathered from goat yards germinates more freely than fresh seed.

*Preservation of seed*

6. The seeds of some kind of trees, such as the mango, neem, jambul, guava and bael and generally most oily or resinous seeds do not retain their germinating power for long and should be sown as soon as possible after being gathered. It is nearly always safest to sow at once all seeds that ripen at seasons suitable for sowing. But some seeds ripen at times not suitable for sowing and the germinating power of some seeds, such as those of the babul and other acacias and some of the cassias, is improved by keeping. Such seeds may be stored in a dry, well ventilated place, where they will not suffer from damp; or in pits excavated in dry raised ground where excess of air and moisture is excluded, and where they can be preserved from the attacks of insects and vermin. One of the best ways is to spread them loosely in layers a few inches thick on a pakka floor as this allows them to be turned over at intervals which should be done especially when the seeds are freshly gathered. As a protection against insects where these are more than usually prevalent it is often useful to mix with the seeds bitter leaves, such as those of the neem or bakain or powerful smelling drugs. Mixing of Gamxona powder a newly introduced insecticide in small quantity with seeds completely prevents all kinds of insect attacks in seed storage of small or large magnitude. Rats, mice, and smaller vermin may be kept off by storing the seeds in Gharras or tin-lined boxes, if in

small quantities, or in the drawers in an almirah. Seeds can also be well kept and protected from damp by suspending in sacks from the roof of the godown, or in large baskets supported on trestles, and by similar devices.

7. Seed which has been allowed to become damp may suffer from mildew or fermentation. To prevent this it should be carefully dried in the shed before it is stored. This is especially important where the seed is to be stored in closed receptacles, such as bottles, tins, etc. Seed which is naturally full of moisture or fleshy may be stored for some time, mixed with dry earth or charcoal dust, in a box or gharra but it is preferable to sow such seed at once whenever possible.

*Testing seed*

8. As it is a waste of ground, labour and money to sow bad seed, all seed should be tested before sowing whenever there is any doubt of its soundness. A rough practical test may be made by placing some of the seed on an iron plate nearly red hot, when all the sound seeds will burst before burning and the proportion of sound seed can then be judged. A more reliable test, which however takes a longer time, is to sow some of the seed, after counting, in a pot of moist earth, and keep it in a warm and preferably dark place. The number of seeds which germinate can then be counted and this will show the proportion of good seeds.

*Quantity of seed required*

9. It is impossible to give any general rules for estimating the quantity of seed required to produce a given number of plants, but it may be said that, as a rule two plants should be raised for each one that is required for planting. Some seeds germinate freely, some the reverse ; casualties will occur both before and at the time of planting where required ; though the seed is gathered from healthy matured trees alone, the seedlings will very in health and vitality and all weakly seedlings should be scrapped. As a rule, therefore, a very much larger quantity of seeds should be sown than would apparently be sufficient to give the number of plants required.

10. In arranging for the collection or supply of seeds an ample margin should be provided to allow for failures in germination and for weakly seedlings which have to be rejected ; to

assist in finding the quantity of seeds required, the number of seeds to the seer is given, where known, for each kind of tree in the list of suitable trees.

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## CHAPTER VI

### PROPAGATION OF TREES; NURSERIES

*Methods of propagation*

1. There are various methods of propagating trees :—

(1) Direct sowing of seed where the tree is required to be grown;

(2) Sowing the seed in seed-beds and transplanting direct to site.

(3) Sowing the seed in a seed-bed transplanting the young seedlings into pots or into the ground in the nursery, and then planting them out in their permanent positions when they are large enough;

(4) Planting cuttings ;

(5) Detaching and planting root-suckers.

Of these methods, Nos. (3) is the most importnat for those for whose guidance this manual is intended. For roadside tree-planting, the method of transplanting the seedlings into pots or baskets is the best. Cuttings may be used in the case of species which do not seed freely ; or, in order to obtain plants of some size, as in the case of the different species of Ficus which root fairly readily. An avenue (of Babul, for instance) can be reared, by sowing seed in situ, in prepared pits, along the sides of the road and afterwards thinning out the seedlings.

*Selection of sites for nurseries*

2. In selecting the nursery, the following are the chief considerations to be taken into account, viz., (1) locality, (2) facilities for obtaining water, (3) shade requirements, (4) soil, (5) facility for supervision. The site of the nursery should be above the level of floods and as near as possible to the road or portion of a road which is to be planted. It should be made large enough to meet the requirements for which it is made. It will often be found convenient as already stated to establish a nursery in the compound of an Inspection Bungalow, where